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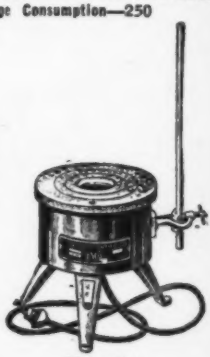

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Journal of Oil and Fat Industries

Devoted to Oils, Fats and Allied Industries

VOL. III **MARCH, 1926** **No. 3**

EDITORIAL

THE LABORATORY AS A STEPPING STONE IN THE FAT AND OIL INDUSTRY

A series of articles in a well-known scientific journal give the reasons of several prominent chemists for their choice of this profession. Perhaps it would be equally instructive, if not as inspiring, to have another series telling why chemists become something else.

In the old days of the sailing vessel, there used to be an expression that described promotion as "crawling in at the hawser hole and climbing to the captain's cabin." Similarly, in the early days of the fat and oil industry, men rose from the lower ranks to the higher positions by sheer force of character, ability and industry.

With the advent of the chemist came men with added qualifications. While their training enabled them to quickly grasp the details of factory operations, it gave them also the opportunity to apply their science to improving the manufacturing process. These chemists were quick to see the greater profits in the commercial as distinguished from the purely scientific end of the industry, and they worked from the laboratory to the factory and from the factory to the office. We can identify many present and former members of the American Oil Chemists' Society who have become presidents, vice-presidents, and general managers of their organization, and the list will ever grow longer.

In some companies it was common practice for many years to promote young chemists to be refiners, then superintendents, and finally office executives. This doubtless was a good plan when the chemists so selected have a well developed business sense and executive ability.

In many cases chemists came from schools where their scientific instincts rather than their executive powers were developed; where they were taught to think in terms of atoms and molecules rather than in dollars and cents, and in chemical reactions rather than in human relations. Except in rare instances men with such training have stuck to their profession and

have not reaped the greater material rewards of the commercial side of the business. In a few cases, by applying science to the practical problems of the industry, they have reaped greater rewards than those working in the commercial field.

It seems reasonable to think that a man's advancement depends primarily or character and ability, and afterward on training. A combination of the purely scientific attitude, which searches only for the truth, and a thorough drilling in business methods would give good ground work in any industry upon which to build for advancement.

A new method of training office executives is being tried out by a very large concern; it has a great deal of promise. Young college graduates who have a good standing in mathematics, economics, business methods, etc., are selected. Then, instead of starting them in the office, the company sends them to the factory where they are put to work on one operation after another until they are fully familiar with all the manufacturing processes. Then and then only are they considered ready to attack the office work intelligently, and they grow to positions which their all-around training will enable them to fill efficiently.

Other things being equal, the best men for executive positions are those who have had the best all-around training. The best chemist is the one who has had the best scientific instruction, combined with the industry and ability to apply his scientific knowledge to bringing forth useful results. —D. W.

THE KEEPING QUALITY OF CRUDE COTTONSEED OIL

By GEORGE S. JAMIESON AND WALTER F. BAUGHMAN

The study here reported was conducted in connection with Investigation No. 2, "Isolation and Identification of the Constituents of Crude Cottonseed Oil with Special Reference to Effect on Refining Loss and Quality," which was submitted by the Basic Research Committee of the Interstate Cottonseed Crushers' Association and the American Oil Chemists' Society.

It is generally believed that the common practice of allowing crude oil to remain in contact with the foots (meal, etc.) at the crude oil mill while waiting for favorable market conditions often results in considerable loss, owing to the deterioration of the oil. Preliminary experiments to get some information about the changes which crude cottonseed oil undergoes during storage were undertaken in the Oil, Fat and Wax Laboratory of the Bureau of Chemistry. The oils used were expressed hot from decorticated seed at the laboratory, so that all changes taking place directly after expressing might be noted. It was the practice to filter a portion of the crude oil through paper as soon as it had been expressed. From 700 to 800 grams of each filtered oil was placed in amber-colored glass bottles of a size which left an air space of 150 to 250 c. c. above the oil at the beginning of the experiments. Another set of samples of the unfiltered crude oils, with some of heavier portions of the foots, was collected in similar bottles. Both sets of samples were placed in a dark locker to imitate, so far as possible under ordinary laboratory conditions, the storage of crude oil at the mill.

The characteristic of non-drying and semi-drying oils most influenced during aging is that of acidity; in most instances the iodine number, saponification value, etc., are not appreciably affected until after the oils have become rancid. Consequently, this study was confined to the determination of acidity. The acidity was determined as soon as possible after the expression of the oil and at definite periods thereafter by the following method:

Heat 10 grams of a sample of an oil with 20 c. c. of neutralized 95 per cent alcohol until the mixture is hot. Then titrate in the customary manner with tenth normal potassium hydroxide solution, using phenolphthalein as indicator.

The acidity is here reported as the "acid value," the number of milligrams of potassium hydroxide required to neutralize the free fatty acids in one gram of oil. The acid value multiplied by the factor 0.502 gives the percentage of free fatty acids in terms of oleic acid, which is still the customary manner of reporting the acidity of cottonseed and many other oils in the trade, although it has been shown that the free

fatty acids of an oil contain both saturated and unsaturated acids in about the same proportion as they occur in the neutral or glyceride portion of the oil.[1]

[1] Cotton Oil Press, 7 (No. 2), p. 35 (1923).

ACID VALUES

No. of oil	Sample	1925 May 8	May 9	May 12	June 16	Aug. 10	Oct. 10	Dec. 12	Feb. 1926	Acidity Increase
1	Filtered	2.06	—	2.06	2.06	—	2.08	2.08	2.28	0.22
1	+Foots	2.06	—	2.45	2.45	—	2.48	2.53	2.56	0.50
2	Filtered	—	4.24	4.24	—	—	4.24	4.43	4.43	0.19
2	+Foots	—	4.24	5.02	5.07	5.30	5.37	5.46	5.65	1.41
3	Filtered	—	3.36	3.36	—	—	3.42	3.45	3.45	0.09
3	+Foots	—	3.36	3.46	—	—	3.48	3.48	3.48	0.12

During the period of storage the temperature of the oils ranged from about 19° C. to 25° C., the most common temperature being 21° or 22° C. The variation in the temperature of these samples was subject to frequent change, as compared with that taking place in large quantities of oil held in storage. Without doubt, in the case of the small laboratory samples, this would cause a more rapid development of free fatty acids.

A 2.5 liter sample of filtered oil No. 1, examined in February 1926, gave an acid value of 2.28, which is identical with that given in the table. A similar quantity of No. 3 filtered oil tested the same day gave an acid value of 3.40. These samples were also stored in the dark.

Oil No. 1 and No. 3 were expressed from different lots of seed from Mississippi, and No. 2 was expressed from Tennessee seed. Each oil was examined for acidity after expression. At the end of the second week of storage the acidity was determined monthly. The table does not show all the data obtained. The figures given indicate when the changes in acidity were observed. From a practical standpoint the samples of oil in which the acidity increased no more than 0.5 may be considered as unchanged. So far as possible the treatment given each sample was identical, even the expression.

The results of the experiments here reported indicate that it is impossible to foretell how a given lot of crude cottonseed oil in contact with the foots will act when stored. The writers believe that the crude oil should be separated from the foots as soon as possible after they have settled from the oil.

BUREAU OF CHEMISTRY,
U. S. Department of Agriculture

SULPHUR OLIVE OIL

By H. P. TREVITHICK and M. F. LAURO

There are three general grades of olive oil produced and sold, namely edible, commercial and sulphur olive oil, commonly called olive oil foots. There is still another grade on the market which is called industrial, recovered and redeemed, but this oil is made either by bleaching the sulphur olive oil or in some cases by acidifying the soapstock obtained by refining low grade commercial oils.

In making edible oil, only fresh sound olives are used. These are pressed lightly, cold, without the use of water, steam, or heating, and only a small portion of the oil is removed. This oil may be taken off in one or two pressings, and the resulting products sold either separately as two kinds of edible oil, or mixed and sold as one lot. The acidity of the oil is generally under 1 per cent, the color and flavor excellent, and the oil limpid and clear.

In making commercial oil, no sorting of the olives is necessary. The residue from making edible oil, together with any olives not suitable for edible purposes, are pressed at high pressure, with the use of preheating and the addition of water or steam, until no further oil can be removed by pressure. The pulp is generally subjected to several treatments in making this grade of oil, and there are therefore several grades of commercial oil produced with acids running from 1 per cent to 10 per cent or more, and with varying colors.

After this treatment, the resulting pulp is dried and extracted with carbon bisulphide, which removes all the remaining oil from the mass. The solution of oil and solvent is steam distilled to removed the bisulphide, and the sulphur oil mixed with water is collected in tanks and allowed to settle. The water drops to the bottom of the tank, and the oil is removed by means of a pump and a swinging suction, pumping the oil into storage tanks or into barrels (second hand) for shipment. If by an error on the part of the operator, the suction should be dropped too low, a mixture of water and oil, or even clear water may be pumped. In this case, there may be several barrels which will contain oil mixed with free water, but there should not be more than four or five. Yet we have seen shipments which showed free water in 86 barrels out of three hundred, and some of the barrels were over half water. Such cases, however, fortunately are rare and most shipments are satisfactory in water content. Usually the moisture content of this material is under 3 per cent, this amount of water being entrained by the oil due to the manner of preparation; but this three per cent would not be visible as free water.

As will be seen this oil is a true olive oil, and not a "foots" or settling from the oil. It has the usual characteristics of olive oil. It is

rather thick, however, and the color varies from green deep green though an olive green to a brown. This color is due to the fact that the chlorophyll is extracted from the olives by the carbon bisulphide, and the amount of green chlorophyll present depends upon the condition of the olives, the length of time that the pulp has decomposed before being extracted, etc. In February the sulphur olive oil contains plenty of the green chlorophyll and is generally of a good green color, but later in the year the color is more brownish.

This variation in the color of the oil is shown very distinctly in the soap. A small piece of soap made by saponifying a sample of oil received in February or March will generally be a very distinct dark green in color, but later in the season, the color of the soap turns more brownish, showing all shades of olive greens, and even dark browns. Of course, the condition of the pulp before extraction has considerable to do with the color. If the pulp has been allowed to decompose considerably before it is extracted, the chlorophyll will lose its coloring qualities, and the soap will be much browner. Thus even in the first of the season, samples of new crop oil have been received which did not give a good green colored soap.

This soap test is made as follows:

A 10 gram sample of the oil is weighed into a three or four inch evaporating dish, and placed upon the steam bath. When hot, 8 cc of caustic soda, 20° Beaume, are added and the whole stirred thoroughly. After standing five or ten minutes, the soap is again stirred to thoroughly incorporate the lye and oil. It is then allowed to stand upon the bath until it is completely saponified, about an hour in all.

Also, differences in the age and condition of the pulp produce marked differences in the acidity of the oil, so that free fatty acid contents will vary from 12 per cent or 15 per cent to 50 per cent or more. Due to the fact that this oil is a by-product, and that it is necessary to produce the best edible and commercial oils possible, it is not feasible to regulate the conditions of the manufacture of the sulphur oil, and therefore it is difficult to know before delivery what class of material can be shipped.

Sampling of this oil in cold weather is attended with many difficulties. The pulp oil contains more stearine than olive oil, and therefore has a higher congealing point. In cold weather, this oil becomes quite thick in the barrels. If free water is present in the barrels, an open trier will not show it as the water will run off the sampling instrument. If a closed tube is used, the first plug of hard oil that enters the tube will block it, preventing the entrance of any more material, whether water or oil. Therefore a sampler must be very careful in sampling this material. In fact, if free water is present, the safest method is to dump the barrels containing free water into a tank, allowing the water to settle, and drawing it off and weighing it. Then the moisture content of the balance can be de-

termined by sampling and analyzing as usual. Thus if 100,000 lbs are placed into a tank, and 10,000 lbs. of free water is drawn off, and the balance shows a moisture content of 5 per cent, there will be a total water content of the 10,000 plus 5 per cent of 90,000 or 14,500, or 14.5 per cent of the total.

Where this oil is stored in storage tanks in countries which have rather cold winter weather, considerable variations in the shipments will result, if care is not exercised. Due to the successive coolings, stearine is deposited in the bottom of the tank. If the shipments are drawn from the top without mixing, the more liquid portions will be removed, and the stearine will be left in the tank. When this stearine is finally shipped, it will be more thick than the previous oil, and will have much higher titre, and lower iodine value due to the absence of the more liquid fatty acids.

As stated above, sulphur olive oil has the usual characteristics of olive oil, except that the unsaponifiable content is higher. In olive oil, this is usually under 1 per cent but in sulphur oil it runs up to 2 per cent or 2.50 per cent, and rarely is as low as 1.3 per cent.

In particular, the sulphur oil has a titre value of from 19 to 24, and an iodine value of 79 to 88 or 90. Shipments, however, have been received in which the titre varied from 36 to 39 and the iodine values from 60 to 63. These are clearly not normal, and would usually be classed as adulterated. Although they do not contain their normal proportions of liquid and solid acids, still in this case we did not feel that they were adulterated but that rather they contained excessive amounts of stearine. The only material which would lower the iodine values would be palm oil, the animal fats, and cocoanut or palm kernel oils. Of these, palm oil would change the color, and the amount necessary to produce the above change in the iodine value would not produce the corresponding change in the titre. Except for the change in color, the same can be said for the animal fats. On the other hand, cocoanut oil and palm kernel oil would not change the titre at all. Stearine, however, has a theoretical titre of 60 and iodine value of zero, and the amount necessary to produce the above change in iodine value would produce approximately the corresponding change in the titre. Further, these samples had the normal unsaponifiable content, and the normal acetyl values of sulphur olive oils. The acetyl values of these samples under investigations as well as those of samples of known purity were between 28 and 35.

NEW YORK PRODUCE EXCHANGE,
NEW YORK, March 18, 1924.

FISH OIL RENDERING PLANT FOR CANADA

A fish reduction plant, with a capacity of 40,000 imperial gallons of fish oil per month, will be constructed on the north end of Vancouver Island within the next few months for a recently organized local firm and will be in operation next season.

FIRST USE OF SOAP

Just about the time that early man quit wearing skins and in their stead donned garments of wool or linen, he began to think, though not very seriously, of the problem of washing. For a long time, anthropologists tell us, these washings, of self and of clothing, were most infrequent, but washing had begun to be recognized as a necessary, if bothersome something which must be done, if only very occasionally.

At first, as is still the case in the most cannibalistic of the South Sea Islands, washing one's person with water was most distinctly not done. Instead, these personal ablutions were conducted much after the manner still practiced by the nomads of the Arabian desert where sand and sunlight are used in lieu of soap and water.

After this, however, as the dawn of time receded into the past, the use of water gradually came into common practice and washing oneself and one's clothing reached the stage where it became either a religious or social rite.

Incidentally, it was Caesar's soldiers who never washed above the waist, who brought back to Rome from the Gallic war a new substance—the same thing which we now call soap. These soldiers found the war-like German tribes living across the Rhine making and using it. They marveled and then, being Romans, adopted this new substance for their own. That is the way we got soap.—Exchange.

THE BECK BILL

By J. S. ABBOTT

Representative Beck of Wisconsin has introduced into Congress a bill relating to margarine. It is H. R. 5188. According to interviews reported to have been had with Mr. Beck, the bill is intended to put the margarine industry out of business. The purpose of such a drastic effort, according to the reports of these interviews, is to help the dairy industry. The destruction of the margarine industry would help the dairy industry, according to Mr. Beck, by eliminating the consumption of two hundred and fifty million pounds of margarine annually and, therefore, increase the demand for butter to such an extent that its price would be increased.

Dollar butter is the goal apparently of the enemies of margarine. It does not make any difference what sort of hardship this would be to consumers of butter and of margarine. The main thing is to make people pay for their milk and butter. There have been hundreds of editorials in as many newspapers of the country to the effect that this is the purpose of all of this opposition to margarine.

It is well known that margarine is a pure and wholesome article of food. It is also well known that it is made of farm products. It is sold in harmony with city, state and federal laws designed to regulate the manufacture and sale of foods and to prevent any fraud and deception in the sale of such products. In a recent Wisconsin court decision, the court announced as one of its Findings of Facts that there is no fraud in the manufacture and sale of margarine in Wisconsin.

It is perfectly well known that there is no fraud problem and no public health problem in the manufacture and sale of margarine. The only objection to it is that it competes with butter. The butter manufacturers apparently don't want this competition.

The Beck bill provides, among other things, that manufacturers and wholesale dealers in margarine shall be taxed $1,000 per annum. It also provides that all margarine be taxed 10 cents per pound. It also provides that retail margarine dealers shall be taxed $100 per annum. Such taxes would of course be equivalent to an outright prohibition of the manufacture and sale of margarine.

The prohibition of the manufacture and sale of margarine is an injustice upon the consumers of the product. It is also an injustice upon the consumers of butter. It would help a very small per cent of the population of this country engaged in the butter business. It would be a hardship upon more than 90 per cent of the people of this country who are eating butter and margarine and who would have to pay a consequently higher price for butter if margarine were eliminated.

INSTITUTE OF MARGARINE MANUFACTURERS
Washington, D. C.
March, 1924

CONGRESS WOULD OUTLAW THE MARGARINE MAKER

The following communications from Dr. Harvey Wiley, noted as the author of the Pure Food Law, to Senator Ellison D. Smith is of direct interest to manufacturers of all edible fats. Representative Beck recently introduced in Congress a bill (H. R. 5188) that imposes such prohibitive taxes on the manufacture and distribution of margarine as to make traffic of any sort in that product impossible. Dr. Wiley is recognized everywhere as the foremost proponent of pure foods in the country. His attitude toward oleomargine, expressed in these two letters, is that oleomargarine is a legitimate article of commerce and is entitled to a place in our markets without discrimination. Dr. Wiley's first letter follows:

Dear Senator:

I am constrained to address you on a matter which I think of very great importance, and also in which the principle of ethics is involved. I refer to H. R. 5188, a bill introduced by Mr. Beck, which has for its purpose principally, the following:

1. Taxing margarine manufacturers $1,000 per annum.
2. Taxing wholesale dealers $1,000 per annum.
3. Taxing retail dealers $100 per annum.
4. Taxing uncolored margarine 10 cents per pound: retaining a tax of 10 cents a pound on colored margarine.

No one has been more vigilant in opposition to the sale of oleomargarine for butter than I have. I have always recognized, however, that oleomargarine is a legitimate article of commerce. It is just as much a farm product as butter and, therefore, the taxing of oleomargarine to any extent further than that necessary to control its manufacture, has always seemed to me to be putting a tax which the consumer has to pay.

The evident purpose of the bill is to make it impossible to manufacture and sell oleomargarine. While I believe in the largest possible consumption of milk and milk products, compatible with the purchasing power of our people, I fail to see either justice or dietary security in saying that the fats of other animals shall not be made and sold, provided no fraud is committed in the process.

The same is true of vegetable oils. They are farm products. They have the same right to an open market as other oils and fats. They have high dietary properties which are fully recognized, and yet, when in the form of oleomargarine, heavy taxes are already laid upon them. I have no objection to allowing a tax of 10 cents a pound on oleomargarine that is artificially colored, provided all fats that are artificially colored are included in the list. It is the discrimination of one kind of fat against another to which I must raise my voice in protest.

There is now on the market millions of pounds of butter made from rotten cream. The process is known as the neutralizing process. Every pound of this butter comes into consumption under fancy dairy names. It is only because of the deterioration of the quality of pure butter, due to the introduction of this undesirable element that people know about it. It is undoubtedly an adulterated butter, and is covered by a law already in existence, and yet not a single pound of it is marked as adulterated butter, or pays the tax now laid upon adulterated butter of 10 cents a pound.

I hope someone will move to amend this bill 5188 by providing that any butter artificially colored shall be regarded as taxable at 10 cents a pound, and all butter made from cream which has been treated with chemicals shall be adulterated butter and pay 10 cents a pound, and that all dealers in such adulterated butter or such colored butter shall pay the same fees that are suggested in the bill for those who are dealing in oleomargarine. There is, my dear Senator, an apparent disposition on the part of some agricultural interests to tax other agricultural interests so that they may prosper. This bill is a shining example of such baleful influences.

Another bill before Congress, and one which the Senate has already adopted, legalizes the adulteration of sugar with a different kind of sugar, far inferior in sweetening powers to the ordinary sugar, and yet which may be used without notice to the consumer in quantities limited only by the ability to manufacture this new sugar and place it upon the market. Are we coming to a pass in this country when one agricultural industry shall be pitted against another in discriminatory legislation? It seems to me that this is about the poorest way possible to alleviate the financial condition of our farmers that can be devised. I beg of you, Senator, to use your influence and your vote to put a stop to this discriminatory legislation in agricultural products.

H. W. WILEY.

Dear Senator:

I am very happy to comply with your request in regard to the food value of vegetable oils, including, of course, cottonseed oil. I assume, of course, that all of these oils are properly refined and ready for consumption.

Insofar as furnishing heat and energy are concerned, and these are the chief functions of all fats and oils, there is no difference between animal oil and vegetable oil. They have practically the same value in supplying heat and energy to the body and muscles. Unfortunately, all the vegetable oils are practically free from any vitamine content. Certain animal oils are quite rich in vitamins, as, for instance, butter fat. Not only does butter fat furnish an equivalent of heat and energy, the same as an equal dry weight of vegetable oils, but it supplies also valuable vitamines which are very important in growth and health. Other animal fats that are adjacent to the vital organs, such as the kidney, the heart and the liver, contain a smaller quantity of vitamines than butter, but still a considerable amount.

As we get plenty of vitamines, however, in milk, fruits and vegetables to supply our wants, this difference, while important, is not a dominant one.

The great function of fats and oils is to supply heat, and through heat, energy. Many people think that the fats which we eat enter into the fats of the human body. This is not the case. All the fats we eat are burned in the body. The fats that are deposited in our bodies are made from sugar and starch and not from the fats we eat.

I will ask Mr. Abbott to send you a copy of an address which I gave before the Oleomargarine Society at Atlantic City a few years ago, entitled, "The Role of Fat in Nutrition." I think you will find valuable data in this address. I have been from the very start an opponent of discriminatory legislation in regard to fats. I have brought down upon my head the disdain of many butter makers although I have conducted for many years a dairy on my farm in Virginia and was contributing, until last September, when I sold my dairy, milk and cream for the consumption of the citizens of Washington. I have always believed it was an unwarranted discrimination to tax oleomargarine colored yellow 10 cents a pound and allow butter to be colored yellow with no tax at all.

I have been bitterly opposed to the use of renovated cream, totally unfit for the manufacture of butter, by treating it with chemicals and neutralizing its excessive rancidity and putting this butter on the market under fancy names without any notice whatever of its character.

The Attorney-General, in Wilson's last Administration, when asked to rule upon this matter, decided that such butter was adulterated and should bear a tax of 10 cents a pound. Mr. Williams, Commissioner of Internal Revenue, under the last Wilson Administration, issued an order placing a tax of this character on such butter. Before, however, the matter was fully decided, the Administration changed and the new Attorney-General and the new Commissioner of Agricultural, revoked this order. Millions of pounds of this butter now go to the consumer without any notice whatever of its character. I believe that such butter should be designated as adulterated and pay the tax which the present law already assesses.

I look upon the so-called Beck Bill as a final attempt to put oleomargarine manufacturers out of business entirely. That is taxing one branch of agricultural products most heavily for the benefit of another. I consider the pending bill in the house which has already passed the Senate permitting the adulteration of sugar without notice a discriminatory measure of the same character. Taxing one agricultural product, that is, permitting it to be adulterated in the interest of another agricultural product. I consider these very poor measures for the relief of the distress among our farmers at the present time. H. W. WILEY.

MORE COTTONSEED FEEDING TESTS

The North Carolina Experiment Station at Raleigh is conducting experiments to determine the effect of heavy cottonseed meal feeding on reproduction and lactation of cows. Cows and heifers have been fed a ration of about eleven pounds of cottonseed meal per day per head, and have been receiving this regularly since the first of the year. Animals are reported as doing nicely but the experiment station wants two years, or until the animals have passed through two lactation periods and the calves held under close observation, before the experiments are completed.

COTTONSEED OIL CHAIR AT TEXAS A. & M.

The Texas Cottonseed Crushers' Association has appointed a committee to secure a chair at the Agricultural & Mechanical College of Texas for teaching cottonseed crushing and refining. A complete laboratory for crushing seed, refining oil and making cooking fats will be installed shortly under the direction of the department of chemical engineering. With the establishment of the chair and the laboratory, Texas will have taken its first step to provide training for the young men of the state who wish to engage in one of the greatest industries in Texas.

TULSA SYMPOSIUM PAPERS

Dr. David Wesson, Chairman of the Symposium to be held at Tulsa, Oklahoma, April 5 to 8, announces the following as a complete list of the papers to be read at that time: Importance of Cotton Cellulose as a Chemical Raw Material, by Gustavus J. Esselen, Jr.; The Deterioration of Cottonseed by Moisture, by John Malowan; Gossypol and Cottonseed Meal Poisoning, by Dr. E. W. Schwartze; Oxidizability of Vitamin "A" in Foods, by Dr. E. F. Kohman; Mineral Constituents of the Cotton Plant, by Dr. J. S. McFargue; Effect of Cottonseed Meal in the Dairy Ration, by Professor R. S. Curtis; Heterogeneous Catalysis—Hydrogenation of Cottonseed Oil with Platinum, by A. H. Richardson and A. O. Snoddy; Practical Versus the Theoretical Side of Oil Extraction, by Louis C. Whitton; Determination of Oil in Mill Products by the Refractometer, by D. A. Coleman; Susceptibility of Fats and Oils to Auto-Oxidation, by G. E. Holm; Effect of Cottonseed Feeding on Butter Fat, by J. F. Geisler; Feeding Value of Cottonseed Meal, by Dr. G. S. Fraps; Butter Fat Analyses as Affected by Cattle Feeding, by J. C. Brown and Dr. G. L. McKay; Cotton as a Food Product, by David Wesson.

CHINA WOOD OIL

By MAXIMILIAN TOCH

This concludes a series of three papers on China Wood Oil which gives us what may be considered the most authoritative discussion of the subject that has been written to date. Recent investigations have so altered the situation in regard to China Wood Oil as to lend special importance to an exhaustive analysis such as this. On that account we requested and secured permission to reprint what appears as a chapter in the third edition of Toch's Chemistry and Technology of Paints. D. Var Nostrand & Company. New York.—*The Editor.*

It will be seen from foregoing pages that the archaic method of collecting seeds from trees that receive no cultivation or attention whatever produces variable oil, and that for the further reason that the nuts are allowed to rot and split, and then heated without any care as to uniform temperature. Many of our scientific statements are not to be relied on excepting for the particular sample examined, owing to the conditions of manufacture.

For fifteen years experiments have been made in an attempt to grow the tung oil in the United States, and to find a suitable climate for its propagation. There is no doubt that below Jacksonville in Florida any species of wood oil tree will prosper. There is no question that by obtaining seeds that grow in Hupeh and Szechuan Provinces which are 30 deg. North, trees can be grown which will prosper in Tennessee, Georgia and the Carolinas, but for the present Florida will give us a large quantity of oil, and a private corporation (Benjamin Moore & Co.) is planting between 2,500 and 3,000 acres adjacent to the plantations of the American Wood Oil Corporation.

It is very interesting to us that the oil produced from the seeds in Florida have different characteristics from the Chinese oil, but this is to be expected by anyone familiar with the transplanting of indigenous plants.

Tung oil produced in Florida in 1924 has the following characteristics and constants:

Percentages of Oil in Meat[1] (By Extraction)
64 Per Cent

Character of Oil Pressed from Meats

Color: very pale—almost water white	
Specific Gravity at 15.5° C.	0.941
Acid value in Alcohol-Benzol	0.0
Saponification value	194.3
Iodine value (half-hour, Wijs)	166.6
Refractive index at 25° C.	1.5193
Browne heat test (A.S.T.M.)—minutes	9¼

Fruits from S. Tarnok (Augusta, Ga.)

Character of Oil Pressed from Meats

Color: very pale—almost water white	
Specific Gravity at 15.5° C.	0.940
Acid value in Alcohol-Benzol	0.0
Saponification value	195.0
Iodine value (half-hour, Wijs)	165.6
Refractive index at 25° C.	1.5188
Browne heat test (A.S.T.M.)—minutes	9½

Sample of American Tung Oil

General appearance: golden yellow in color and very clear	
Specific Gravity (15.5° C.)	0.941
Refractive index (25° C.)	1.5195
Dispersion Value (25° C.)	0.02129
Acid Number in Alcohol-Benzol	1.13
Iodine Number (one hour Wijs)	175
Saponification value	195.5
Heat Test (100 gm. Worstall's)	6¾

The gel is very pale in color, dry and firm; cut and crumbled very well. This sample is pure tung oil of exceptionally good quality.

One half of this sample was sent to Dr. Z. Z. Zee at Columbia University whose analysis of this oil is as follows:

Color: very light amber	
Odor: faint but characteristic	
Sp. Gr.	0.9428 (at 15.5° C.)
Ref. Index	1.520 (at 25° C.)
Dispersion	0.02068
Acid No.	1.3
Iodine No.	174
Heat Test	9¾ minutes (Browne's Jelly test, heating at 282° C.

"The quality in my opinion is excellent."

When Havana tobacco from the Vuelta Abajo district, which is acknowledged the finest tobacco in the world, was transplanted to Connecticut and Wisconsin, totally different tobacco was produced which did not even appear like the original, and yet, from the coarse strong tobacco which was originally produced in Connecticut that sold at a few cents per pound, by selective transplanting and proper fertilizing, tobacco is being produced which commands as high, and in some instances, a higher price, than the original Havana tobacco. The transplantation of the French grape to California produced a wine twice as strong in alcohol as the original. Chinese cotton differs from the Egyptian and American cotton. Any indigenous plant transplanted in various parts of the world becomes either better or worse than the original, but it usually has an

Tong Oil Nuts grown in Gainesville, Florida. These cultivated nuts are about twice the size of the Chinese uncultivated nuts

entirely different taste, flavor, or characteristic. It is quite natural, therefore, that tung oil grown in America will be different from tung oil grown in China, and, from present appearances, it will be an oil that is going to be much more uniform and paler in color than anything grown in China. New formulae and methods will have to be devised, as the American oil polymerizes more rapidly and the addition of organic acids or possibly fatty acids in conjunction with rosin may have to be adopted in order to extend the time of polymerization or prevent it entirely, if possible.

One-year old tree, Florida

Unless China wood oil varnish is heated in a kettle above 260° C. and kept there without polymerization, the resulting varnish will only be good in the summer time but not good in our or in other winter climates; for instead of drying with a high gloss it flats selectively, and the only prevention for the flatting of China wood oil where it is not wanted, is to heat the oil without polymerization to a sufficiently high temperature and keep it at that in the presence of organic acids. Fatty acids of linseed oil and rosin are best adapted for the purpose.

The standard method for making wood oil varnish in the case of

rosin is 100 pounds of rosin to 400 pounds of wood oil, but in the case of rosin ester, the standard formula is 150 pounds of rosin ester to 400 pounds of wood oil.

Deodorization of China Wood Oil

It is possible to deodorize China wood oil and rid it of its pernicious characteristics, but up to now it has not been possible to do this on a

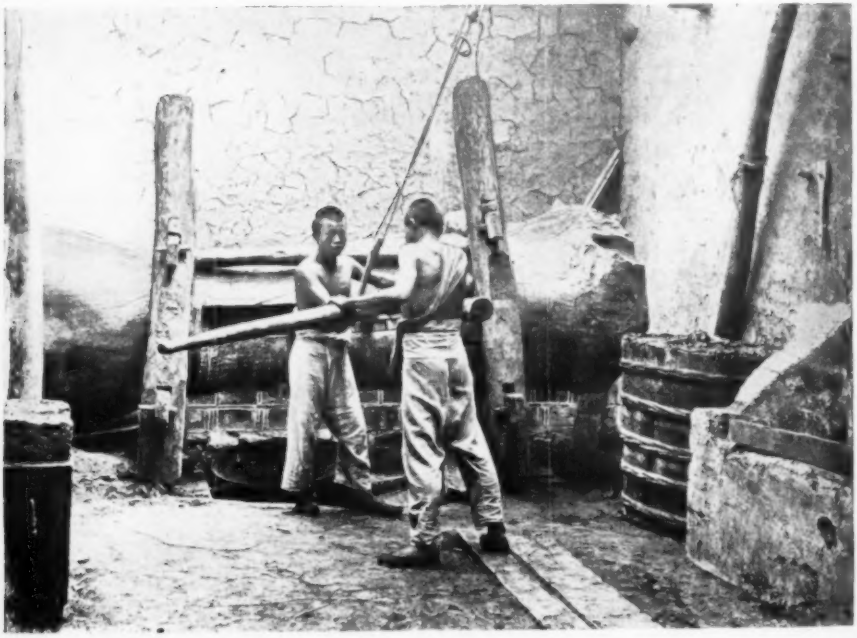
Planting Seedlings, Florida

commercial scale, for there are many difficulties that arise in any process which attempts to extract the material that produces so-called "heathen smell."

China wood oil as grown in America has a very pleasant characteristic odor because the nuts are not allowed to rot and no decaying animal matter can possibly find its way into the American material, but on the Yang-tse River it has become essential to strain the oil as it is poured out of the baskets, through iron wire gratings in order to get rid of any foreign matter, including dead animals.

Starting out with the assumption that the odor is produced by some

Primitive Method of Grinding the Nuts



Chinese Boys Pressing Oil from the Nuts

material which has an analogy to butyric acid or a butyric compound, a large number of samples of oil were heated up to 150° C. and nitrogen and other inert gases were bubbled through them. In every case a reduction of the odor was noticed, but after the oil cooled and was allowed to stand in the light, it changed from a colloid to a crystalloid and, at first, crystals began to float around in the oil until, after 48 hours, the oil had the appearance of a soft wax.

A large number of experiments were tried, adding materials of carbonaceous nature, heating and blowing the oil at the same time, and after filtration the oil became crystalline, and in every instance this condition rendered it unsalable. Air, steam and some of the inert gases produce good results but the oil undergoes a change. This work is worthy for further study and experimentation.

Lumbang Oil

This oil will be suited for paint purposes as soon as care is exercised in the collection of the nuts, which grow in great quantities in the Philippine Islands. As yet, no definite statement can be made as to its constants unless a sample of oil is extracted from clean nuts, as such a sample will differ from the material that is imported into the United States at present. It has been used in some considerable quantities for the purpose of making putty, but there is no reason why it should not be used for paint, as it dries well, has a high iodine number, and, in spite of the method by which it is handled, it has a low acid number.

The specific gravity varies from .930 to .940; saponification value from 190 to 200; iodine value from 160 to 170.

Stillingia Oil

Stillingia oil is obtained from the seeds of stillingia sebifera, native to several parts of China. It is expressed from the seeds after the outer shell and mesocarp have been removed, and is generally of dark color, due to the primitive methods of extraction. Oil of a good pale color can be obtained by more modern treatment.

Tallow seed oil or vegetable tallow is expressed from the mesocarp surrounding the seeds. It is also obtained by pressing the entire nut, seed and all. This oil, which is not of much interest to the paint and varnish industry, is used in China as a substitute for cocoanut oil and tallow in the manufacture of candles and soaps.

Stillingia oil was formerly used only for lighting purposes, but is now widely used in China as both a substitute and adulterant for tung oil. Hard drying, glossy varnishes are made of it.

1. Circular No. 125, "Amer. Tung Oil Culture," Henry A. Gardener.
2. Analyzed by Dr. T. T. Ling, Research Chemist.

MISBRANDING EDIBLE OILS

Seizure of cottonseed and other edible oils by the Department of Agriculture in several different cities is cause for grave concern by packers and distributors of these products. The Department alleges misbranding of these packages because of the statement of contents that appears on the label. An example in point is the appearance on the retail market of olive oil in cans the contents of which is stated on the packages to be 0.98 of 1 gallon. In other instances the contents may be given as 7½ pounds net weight. It is the contention of the Department of Agriculture that this is misbranding in that cans are offered for sale and are purchased as gallon cans. Agents of the Department are said to have made purchases of such packages at retail and the seller has misrepresented these to be gallon packages.

R. W. Dunlap, Acting Secretary of Agriculture, has written the following letter to the JOURNAL OF OIL AND FAT INDUSTRIES. He says:

"The text of the food and drugs act is contained in Circular 21. You will find the so-called net weight amendment in Section 8, paragraph third, in the case of food, on page 25. It states that an article shall be misbranded, 'if in package form, the quantity of the contents be not plainly and conspicuously marked on the outside of the package in terms of weight, measure, or numerical count: Provided, however, that reasonable variations shall be permitted, and tolerances and also exemptions as to small packages shall be established by rules and regulations made in accordance with the provisions of section three of this act.'

"This amendment requires that food in package form be labeled with a plain and conspicuous statement of the quantity of the contents in terms of weight, measure, or numerical count. Under the regulations for the enforcement of this amendment it has been held by the Department that liquids in general should be labeled in terms of net volume. In this connection please note Regulation 26, especially paragraph (e).[2]

"In interpreting the act the Department is of the opinion that the requirement that the net contents declaration be plainly and conspicuously made means that the declaration shall be prominently and legibly declared and also in such terms that it will be readily comprehensible by the average purchaser. There is a practice in certain quarters of packing oils, both cotton seed and olive oil, in containers holding just short of one gallon and labeling them in terms of weight, namely 7½ pounds net weight. Information is available showing that a weight declaration on oils conveys no definite knowledge to the purchaser of the quantity of food contained in the package and that as a matter of fact such packages are usually purchased in the belief that they contain one gallon of oil. Because of the deceptive and unintelligible character of a weight declaration, there-

fore, the Department is of the belief that such a declaration does not comply with the requirements of the net weight amendment. It is held, as I have said above, that the declaration of quantity should be in terms of volume and in such simple terms as to be readily comprehensible.

"As an alternative to a net weight declaration on oils, certain packers have employed the same size containers holding a little less than a gallon and have adopted a declaration in decimal form, such as '0.98 of 1 gallon.' The Department is not convinced that this is a satisfactory way of declaring net volume. It is inclined to believe that there is more possibility of deception of the purchaser in this type of declaration than in one which declares the quantity of contents in terms of quarts, pints and fluid ounces. In fact, the practice of employing short gallon containers as well as containers holding just short of a half gallon and a quart is one which we believe is much more likely to lead to deceit than where containers holding even units of measure are employed.

"Certain packers of oils have adopted the practice of filling their containers by weight on the basis, for example, in the case of olive oil, of 7.61 pounds per gallon. While this figure may represent an average of the weight of a gallon of olive oil, it must be recognized that the specific gravity of oils varies and that a packer of oils, therefore, is under obligations to determine the correct weight per gallon of each lot of oil he is packing if he is to avoid the danger of packing too small or too great a quantity in his containers. The regulations require that a product labeled as containing one gallon shall actually contain one gallon of the oil at 68 Fahrenheit."

R. W. DUNLAP, Acting Secretary, United States Department of Agriculture.

[2]Statement of weight shall be in terms of the avoirdupois pound and ounce; statement of liquid measure shall be in terms of the United States gallon of 231 cubic inches and its customary sub-divisions, i.e., gallons, quarts, pints, or fluid ounces, and shall express the volume of the liquid at 68 F. (20 C.); statement of dry measure shall be in terms of the United States standard bushel of 2,150.42 cubic inches and its customary sub-divisions, i.e., bushels, pecks, quarts, or pints, or in the case of articles in barrels in terms of the United States standard barrel and its lawful sub-divisions, i.e., third, half, or three-quarters barrel, as fixed by the act of March 4, 1915 (38 Stat. 1186): Provided, that statement of quantity may be in terms of metric weight or measure. Statement of metric weight shall be in terms of kilograms or grams. Statement of metric measure shall be in terms of liters or cubic centimeters. Other terms of metric weight or measure may be used if it appears that a definite trade custom exists for marking articles with such other terms and the articles are marked in accordance with the custom.

BUYING AND SELLING ON STANDARD GRADES AND SPECIFICATIONS

By IRVING F. LAUCKS

The following article was presented in the form of an address before the Pacific Foreign Trade Council at San Francisco, March 5. It shows very clearly the need for standard specifications in all fields, and its importance to the oil and fat industries is being recognized by the activity of the American Oil Chemists' Society along these same lines.—*The Editor.*

The United States Bureau of Standards has issued a "National Directory of Commodity Specifications," under date of August 28, 1925 (Miscellaneous Specification No. 65). So far as I am aware, this is the first effective effort that has been made to co-ordinate specifications for all commodities. It is to be sincerely hoped that from this first co-ordination will grow a system of nationally accepted Commodity Standards. Of those now existing some will be eliminated as obsolete, others now too general, will be amplified and new ones will be prepared as the demand for them arises.

The foreword of this "National Directory of Commodity Specifications" appears under the name of Herbert Hoover. Those of us who are engineers have long looked upon Secretary Hoover as a Moses who, in many instances, has shown the way out of the unprofitable desert of misunderstanding to the profitable country of agreement, and the light which he used is "Exact Knowledge of the Facts."

I will quote a few lines from this foreword: "Specifications are the formulated, definite and complete statements of what the buyer requires of the seller."

To this I think should be added: *or of what the seller has to offer to the buyer;* for it sometimes happens that the buyer asks for grade or quality which the seller cannot supply because of crop conditions, raw material limitations or other valid reasons beyond the seller's control. Also the seller often has a new commodity to offer and is the one who must specify its suitability and limitations.

To continue the quotation:

"Specifications must be adapted to the best practice of production and distribution. Their formulation requires the services of chemists, physicists, engineers and what not. *But*, '(and note well this 'but')' beyond this it requires something that has too often been neglected, and that is the added experience of the producer, the manufacturer and the user. No economy is to be obtained by formulating such a specification for an article as will require that it be specially manufactured when an article largely produced for commercial consumption will give equal service, or by setting up of such requirements as will necessitate increased cost of production without compensation in service."

"Buying on Specification" means simply knowing exactly what you want, asking for it and insisting on getting it.

"Selling on Specification" means knowing exactly what you have to sell and supplying your buyer exactly the same product each time.

Now when we add the word "Standard" and say "Buying and Selling on Standard Grade and Specification" we are going another step ahead; for that means that we are going to see first if we cannot adapt our requirements so that they will be filled by a Standard Specified Article instead of specifying an article which is a little off standard size or color, or of a purity which is unnecessary. Also, it means that the seller knows just what requirements he has to meet and he will not waste time nor money in offering a product that is not up to standard.

Application of knowledge to service requirements;
Co-ordination of similar demands:
Elimination of non-essential differences;
Balancing of cost against service improvement;
Taking fullest advantage of existing commercial varieties;
Formulation of adequate test or inspection methods.

These are given as the essentials in writing Standard Specifications. If these essentials are followed, the result will inevitably be the raising and stabilizing of the Quality of American Production.

In foreign trade, if we offer for sale "Standard" goods and always supply what we offer, we will get repeat orders. If—there is another "if" —if our customers fully understand what our standards mean as compared with their ideas of what they want. This calls for patience and a sincere effort on our part to get our customers point of view, whether that customer be in India, China, Japan or South America.

Further, importers have the further great problem of establishing such standards in foreign countries as will enable them to *buy* there under specifications which will enable them to sell in this country without regrading or reclassification.

In other words, what we have to work for is Buying and Selling under World Standards and Specifications. But first we must, as far as possible, and as rapidly as possible put our own house in order by conscientious, consistent, co-operative effort to find out what requirements the purchased article should meet and to furnish goods to meet these requirements, not once only, but every time.

To digress for a moment from Foreign Trade—You are all, doubtless, more or less familiar with the work of the Underwriters Laboratories at Chicago. The Standards for Materials of Construction and Manufactured Forms set up by these Laboratories are all the results of engineering tests, chemical analysis, etc. and also of industrial conferences between manufacturers, users and the laboratory representatives.

Now that is a point I wish to make: no satisfactory workable standards can be set up which do not combine the results of the best thought of the

manufacturer or producer and the user. These two may frequently require the assistance of engineers, chemists and as Mr. Hoover says "what not," in setting up these standards, and in devising tests to determine whether or not the standards are complied with.

Standards are not fixed and unchangeable. The world grows, we develop new materials for old uses and new uses for old materials. We improve products, and what fully met the requirements last year may not meet the requirements next year, and so our standards will have to be raised.

Not so many years ago Peanuts were bought and sold as Fair Average Quality Field Run. In some parts of the world they still are; but, as far as my experience goes, to only a limited extent in this country. The seller said the goods he sold *were* Fair Average Quality Field Run, the buyer (when he got the goods) perhaps said they were not Fair Average Quality. One man's opinion was frequently as good as anothers for no one could satisfactorily establish what Fair Average Quality meant in this case. There we have all the necessary elements of a nice little court case from which no one profited except the lawyers and they are not generally classed as importers and exporters.

Now, however, the seller offers 1925 crop Peanuts, Count 30-32, which will pass the spot test. A disinterested third party or the buyer himself can very quickly determine whether the goods are up to standard or not. If they are not, the seller knows it and he is not faced with the idea that perhaps the buyer is just trying to crawl out. On the other hand, if they are up to Standard the buyer can't reject because he knows he'll be licked if he goes to court, for the standard is a gauge of the commodity which is understandable and can be used by anyone who has good eyes and can count.

You sell steel and fertilizer to the Oriental Countries. Two quite different commodities. The steel is sold under standards established by the U. S. Bureau of Standards and the American Society for Testing Materials. The Fertilizer is also sold under standards which have been set up by the producer and the buyer. The producer knows what is the average ammonia content of the particular kind of Fertilizer he handles and he knows also what is the safe maximum he can guarantee. The Oriental Buyer knows now what minimum ammonia content he will accept and the contract is written accordingly, based on a standard. But the standard in this and other cases must include another provision: the Herring Meal must be "in sound and merchantable condition." While the meal might have had satisfactory ammonia content at time of sampling, if it is not in sound merchantable condition at time of shipment, it may be wholly unsatisfactory on arrival at destination. Ultimately we shall have a "World Standard" for Herring Fertilizers, for instance, which will be

based on the data obtained by the producers and users, assisted by chemists, over a period of years, which standard will represent an acceptable workable average.

Specifications should not be unnecessarily exacting, for instance, if Soya Bean Oil having free fatty acid content of 3 per cent is suitable for use in paint oil manufacture, specify this upper limit instead of the customary 2 per cent and take advantage of the shaded price and leave the lower acid oil for other uses or later purchase.

On the other hand they should not be so loose as to invite substitution or evasion. They should be written with care and, when used in contract forms, should be most carefully checked to avoid any possible misinterpretation.

I. F. Laucks, Inc.
Seattle, Washington

CERTAIN PHYSICAL AND CHEMICAL REQUIREMENTS OF FATS IN THE EVAPORATED MILK INDUSTRY

By H. F. ZOLLER

The following paper was prepared at a time when "filled milk" was in its heyday. Subsequent legislation greatly reduced the commercial importance of the product; but the value of the paper to the scientific investigators has not been diminished.—*The Editor.*

The ice cream, butter and cheese industries generally have a large surplus of skim milk to dispose of during certain seasons of the year. During the last few years a certain amount of this skim milk has been turned into sweetened condensed skim milk which is sold to the baking industry and some to the candy manufacturers. Attempts have been made to put up the skim milk as straight evaporated skim in gallon cans for the candy trade etc., but owing to certain properties possessed by skim milk it is necessary to run the total solids very low (around 20%) in order that it will stand up under sterilization treatment.

Certain companies have, therefore, conceived the idea of adding a fat from some suitable source to this skim milk so that its total solids can be run to around normal content for evaporated whole milk (28%) and still withstand sterilization. The addition of this fat was also welcomed by the candy and baking industries since it would thus be a suitable cooking product in the place of whole evaporated milk. This fat-filled skim milk earned the name in trade of "filled milk" or "milk compound."

Without entering upon a discussion of the commercial ethics of such a product—such discussions engrossed the attention of certain factions in both state and federal government for months—I will try to interest you in certain very fundamental research problems which were uncovered by the manufacturers and laboratories connected with the production of compound milk. It should be said that the aim of the producers of the product always had been to secure a highly refined oil for their purposes and to incorporate it under the most sanitary conditions possible. In many instances the character and physical conditions of this fat filled milk has been much superior to some whole milk batches in its working conditions in the vacuum pan and subsequent sterilization.

Processing of Fats in the Compound Milk Industry

The evaporation of milk in a vacuum pan at the temperature and pressure under factory operation and the subsequent sterilization of the product at high temperatures necessitates the consideration of factors in connection with the constitution and physical make-up of fats which are uncommon in all other industries in which fats are used. We might say that those who were pioneers in the compound milk industry were the unquestionable recipients of luck in the choice of fats for their purpose.

In England and Denmark where the nut margarine industry first flourished, and subsequently in the United States, cocoanut fat and palm nut fat were, and are yet, extensively used to manufacture their product. These two fats are reasonably cheap and are easily refined. The former, cocoanut oil, is available in the United States markets from our insular possessions. Inasmuch as the margarine people were using tons of this oil annually in the production of their product it was but natural that the evaporated milk people should look to this fat as the first possiblity for compound milk. It filled the bill admirably. Just why it should be so valuable for evaporated filled milk will be seen in that which follows.

It is fitting that we should turn first to the properties of butter fat to ascertain the factors which it possesses which renders it capable of standing up fairly well during the evaporation in the vacuum pan and during sterilization. An authoritative table of its properties is compiled below: (Leach & Winton; & Allen).

TABLE I.

Factor	Range
Melting Point	28°- 36°C
Solidifying Point	19 - 24°C
Saponification No.	220 -241
Iodine No.	26 - 38
Specific Gr.	0.865 - 0.870
Ref. Ind.	1.4527 - 1.4566
Acetyl No.	1.9 - 8.4

Comparison figures of the various fats suitable for evaporated milk and those which are not suitable as they exist naturally appear in Table II.

TABLE II.

Fat	Melting-Pt. Deg. C.	Solidifying-Pt. Deg. C.	Iodine No.	Saponification No.	Acetyl No.
Butter fat	28-36	19-24	26-38	220-241	1.9- 8.4
Cocoanut fat	20-28	14-23	8-10	246-261	0.9-12.3
Palmnut fat	23-30	20-27	13-18	242-255	1.9- 8.4
Cottonseed		5- 0	104-117	191-195	21. -25.
Peanut		0- 3	83-105	186-196	9.1
Corn		12-10	116-130	189-194	..
Soya Bean		14-15-3	114-139	207-212	..

In the first place butter fat is soft at ordinary room temperature, which bespeaks a fairly moderate content of stearin and palmatin. It contains a very moderate amount of unsaturated glycerines, thus yielding an iodine number of low order. In fact the iodine number of butter fat is from one fourth to one third as high as that of either cottonseed, peanut, corn or soya bean oil. The saponification number is quite high, higher than the same index for the above named oils.

Now we can take the group of food fats which I have termed the butterfat group and which includes butter fat, cocoanut and palm nut, and we can compare this group with another which I have called the cottonoil group and which included cottonseed, peanut, corn and soya bean oil.

The melting point range for all the fats in the butter fat group is from 20 deg. C to 36, whereas the cotton oil group are all liquid fats at room temperatures and do not solidify until 3 deg. C or lower is reached. The solidifying point of the butter fat group ranges from 14 to 27 deg. C.

The iodine numbers of the butter fat group range between 8.0 to 10. for cocoanut, to 26-38 for butter fat, with palm nut fat intermediate. Now with the cotton oil group this factor is from 83 to 139; soya bean oil being least saturated and corn oil next, then following peanut and cotton seed.

The saponification numbers for the butter fat group are between 220 and 261, whereas the cotton oil group lie between 186 and 212.

The acetyl numbers for the butter fat group are all small (i.e., 0.9 to 12.3); while cottonseed oil yields 21 to 25 and peanut greater than 9.1.

We could continue in noting group differences among the physical and chemical factors which have been determined for these fats, but those already mentioned are sufficient to indicate the close relationship to butter fat borne by cocoanut fat and palmnut fat. Is it any wonder then that we believe the evaporated milk people fell into a lucky choice when cocoanut oil was selected to mix with the skim milk? The volatile fatty acids resulting from the hydrolysis of butter fat and cocoanut oil are quite similar in qualitative and quantitative features, the absence of butyric acid in cocoanut oil being the chief difference.

TABLE III.

Fatty Acids obtained by Hydrolysis of the Purified Fats.

Acids	Butterfat % (X)	Cocoanut Fat % (/)
Butyric	5.45	..
Caproic	2.09	2
Caprylic	0.49	9
Capric	0.32	10
Laurie	2.57	45
Myristic	9.89	20
Palmitic	38.61	7
Stearic	1.83	5
Oleic	32.50	2
Dihydroxy Stearic	1.00	..

(x) Brown, J. Am. Chem. Soc. 21, 807 (1899).
(/) Elsdon, Analyst, 38, 8 (1912).

The three fats in this group also contain myristin. The margarine people chose a product very similar to butter in both chemical and physical properties, except that cocoanut oil needed to be hardened in some manner to raise its melting and solidifying point, either by direct hydrogenation or the addition of some other hardened fat.

Now why is it that the fats in the cotton oil series are unsuited, as they exist, for evaporated milk production? In the first place, they all develop more or less rancidity* in the vacuum pan and this is not improved in the sterilization process. In the second place some of them possess certain characteristic flavors in themselves which makes their presence in the sterilized milk obnoxious. These certain characteristic flavors are tied up

*The term rancidity is here used in a loose sense and refers to actual hydrolysis of the fat taking place in both vacuum pan and cans during heat treatment.

intimately with certain protein traces, unusual glycerides or other bodies, and the consequent difficulty of refining the oil so as to eliminate these from the finished product. The highest quality of refined oils as they exist on the market, of this group, are not suitable for regular production of compound milk. We have tried to hydrogenate various of these oils to certain degrees so that we would have a product with a satisfactory melting point for pan use, and a fat with an iodine number low enough to fall within the butter group. In this we met with a very interesting and important observation. As is well known, fats when partially or completely hydrogenated, develop a very marked tallowy odor (and this odor becomes a real flavor in practice); this is more pronounced the greater the degree of hydrogenation, and is characterized in trade parlance as hydrogenation flavor. This tallowy odor or flavor is entirely removed in the vacuum pan in the presence of the milk. I do not mean that the milk absorbs the product causing this odor, but that it is carried out in the condenser water during the concentration. Therefore this constitutes a thread from which it is possible to work out a process of removing hydrogenation flavor.

These partially hydrogenated fats can be used in the compound milk industry providing the iodine number has been reduced to the neighborhood of 30 or lower and the melting and solidifying points are not greater than 50° C. It is very definitely shown in our experience that the iodine number (which is an index of unsaturated glyceride content of a fat) is the controlling factor in rancidity development. But why use these products when cocoanut fat is the natural substitute for butter fat in the United States both economically and nutritionally? I beg to state here that the term nutritional is used in its broader sense and should not be construed to indicate any connection to the vitamin controversy, a controversy which has been used inconsistently and with results unfortunate for filled milk.

The cocoanut oil used to incorporate with the milk is of selected stock. It must have no rancidity or free acid, foreign odor or tallowiness, and it should show only a faint greenish-yellow tint when melted. These requirements are met without any difficulty on the part of the cocoanut oil refiners.

It has been urged, in connection with the tariff, that cocoanut oil receive a heavy tax because it is an imported oil, and is jeopardizing our home grown oil industry. While I believe that such legislation, if any is to be directed at vegetable fats, could without much hardship tax palm nut fat, I am directly opposed to the inclusion of cocoanut fat. Research has very definitely shown that the glyceride balance in cocoanut fat is closely analogous to butter fat. It has further revealed the similarity in physical properties. While this is also true of palm nut oil, the latter is not so extensively produced in United States territories, and could be dispensed with providing a large production of cocoanut oil could be guaranteed.

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ABSTRACTS FROM OTHER JOURNALS

From JOURNAL OF SOCIETY OF CHEMICAL INDUSTRY

By DAVID WESSON

Free Fatty Acids in Palm Oil. A. C. Barnes (Bull. Mat. Grasses, 1924, 304-322). The acidity of the pulp oil, which is largely due to the enzyme in the pulp cells coming into contact with the oil, does not increase to any marked extent for some 7-9 days when ripe fruit heads are kept dry and well ventilated, and the development is slower in fruits that fall naturally. Mold growth results in production of enzymes which are an additional factor causing increase of acidity, and acidity in an oil containing enzymes will increase during storage. It is, therefore, of advantage to free the oil from all vegetable debris by filtration, and heating to 110° prevents hydrolysis. If the fruit is kept at 55° for 10 min. by heating in water, the action of the pulp enzyme is completely checked, and the color of the oil is not damaged. Removing the pericarp of the fruit in solutions of various chemicals, results in certain changes in acidity, e.g., when 1 per cent sodium carbonate was used the acidity of the oil was only 2.9 per cent, compared with 27 per cent in oil extracted under ordinary conditions. The acidity of the oil was also diminished by use of dilute sulphuric acid; sodium chloride and tannic acid tended to increase it, and sodium sulphate and ammonium alum had little effect.—D. G. H.

Refining of Oils and Fats. Lever Bros. Ltd., and R. Craig (E. P. 224,928, 24.5.23). Precipitable and coagulable impurities are separated by means of acid-treated bleaching earth, e.g., "Tonsil A. C.," and free fatty acids and volatile odoriferous substances are then removed by passing steam through the oil, the surface of which is maintained under very low absolute pressure, air being excluded until the oil is cool.—D. G. H.

Tests for Rancidity in Fats. J. Bulir (Chem. Ind., 1925, 19, 357-362). Rancid fats contain products which give peroxide reactions, and in testing for these p-diaminodiphenylamine sulphate is a good reagent. A surer method is as follows: shake 1 c.c. of the fat dissolved in 1 c.c. of light petroleum with 2 c.c. of 20 per cent alcoholic potassium iodide solution, add 15 c.c. of water, shake, and test the aqueous layer with starch paste. A blue color indicates that the fat is rancid.—B. W. Anderson.

Purifying Oils and Fats Under a High Vacuum by Means of Steam or the Like. Metallbank U. Metallurgische Ges., and W. Gensecke (E. P. 242,739, 17.9.24). Steam led into the oil or fat contained in a vacuum vessel is withdrawn from the vessel by a special injector (cf. E. P. 237,309) and may then be passed through a second vacuum vessel before being condensed. The injector is provided, in front of the convergent guide conduit with an additional nozzle which increases the velocity of the steam and decreases its pressure. The vacuum obtained is higher and the steam consumption lower than in the ordinary vacuum condenser plant.—G. T. Peard.

Mixed Esters (Glycerides) of Lower and Higher Fatty Acids. G. L. Schwartz, Assr. to E. I. du Pont de Nemours and Co. (U. S. P. 1,558,299, 20.10.25. Appl., 11.4.22). Glycerin is heated with acetic acid and the acids from coconut oil in presence of a small quantity of sulphuric acid, and any water formed is removed by passing a current of nitrogen through the mixture. A product which is for the most part the diacetylmonoglyceride of the coconut oil acids is obtained. It has a low freezing point, is non-volatile, and rapidly colloids pyroxylin. A similar product is obtained by using coconut oil, acetic acid and glycerin.—T. S. Wheeler.

Higher Fatty Acids of Peanut (Arachis) Oil. W. D. Cohen (Proc. K. Akad. Wetensch, Amsterdam, 1925, 28, 630-635). Repeated fractional distillation in a vacuum (0.001 mm.) of the ethyl esters of the higher fatty acids present in arachis oil effects a separation into two fractions, (1) m.p. 42.5°, (2) m.p. 53.5-54°, which on hydrolysis yield respectively arachidic acid, m.p. 74.5-75°, and a C_{24} acid, m.p. 80-80.5°, the properties of which render it probable that it is a straight-chain acid belonging to the same homologous series; each acid is present to the extent of 3-4 per cent of the total fatty acids. No trace of a C_{22} acid could be detected, the substance obtained by Ehrenstein and Stuewer (B., 1923, 1031 A) being probably a mixture, since effective separation cannot be obtained by distillation in an ordinary filter-pump vacuum.—J. W. Baker.

Application of Measurement of Capillary Forces to Study of Fatty Acids. R. Dubrisay (Compt. rend., 1925, 181, 1060-1061). Surface tensions of fatty acids in benzene solution in contact with dilute soda solutions have been determined by the drop method. An equimolecular mixture of stearic and myristic acids has the same refractive index as palmitic acid, but they may be differentiated readily by surface tension measurements. An equimolecular mixture of stearic and palmitic acids has a different surface tension from daturic acid (cf. Gerard, B., 1890, 1137).—L. F. Hewitt.

Detergent and Antiseptic Value of Perfume Material in Toilet Soap. J. J. Bryant (Perf. Ess. Oil Rec., 1924, 15, 426-431). Toilet soaps were compared with simliar unperfumed bases for detergent values by means of Clark's method of determining the hardness of water and by the carbon suspension process. The values obtained show that the perfume materials do add to the detergent value. A comparison of the different perfumes (essential oils and synthetics) was made by making up 1 per cent of each with a common soap base, leaving to mature for 30 days, and testing as above. In 63 per cent of the cases an improvement was observed due to the perfume and the negative results in the other cases may be due to the volatile character of the perfume. A similar procedure was followed in studying the bactericidal values, the "Lancet" method of determining the Rideal-Walker carbolic acid coefficient being used. Here again an increase in value was noted where the perfume was present, and a table showing comparative values for the essential oils and synthetics used is given.—D. G. H.

Determination of the Melting Point of Cacao Butter. T. Sabalitschka (Z. Angew. Chem., 1925, 38, 1013-1014). The author confirms the results of several investigators according to which a sample of melted cacao butter in a capillary, even if kept in ice, requires several weeks to attain completely the solid state. Melting-point results with incompletely solidified samples are too low. Welmanns' method (Pharm. Ztg., 1900, 45, 959), in which the sample does not require to be previously melted, is coming more and more into use (cf. Fincke, B., 1925, 640).—C. Irwin.

Evolution of Hydrogen Peroxide by Oils on Exposure to Light. G. F. A. Stutz, H. A. Nelson and F. S. Schmutz (Ind. Eng. Chem., 1925, 17, 1138-1141). Seeds, oils and resins from vegetable sources affect the sensitive photographic plate in a manner similar to the action of light, and evidence has been accumulated that this action is due to hydrogen peroxide evolved from the materials. In the case of oils the effect is greatly increased on exposure to light. Saturated fatty acids from the oils are inactive, and unsaturated fatty acids strongly active, therefore, the phenomenon is associated with the drying of an oil, and probably with the entire process of oxidation of the oil film. Tests with various oils which were exposed to light at a distance of 36 cm. from a standard mercury vapor lamp showed that in general the drying oils reach a maximum and then decrease within two hours of exposure, whilst the non-drying oils show a steadier increase with no maximum, in the same period. Apparently in the case of drying oils a rapid reaction chiefly on the surface takes place with the formation of a skin relatively impervious to hydrogen peroxides. Of various metal soaps added to linseed oil, those that greatly accelerated drying showed no effect, whereas those that accelerated drying but little had a strong effect. The primary oxidation of an oil is probably a molecular autoxidation, whereby molecules of oxygen are added at the double linkings, thus forming peroxides. Further action probably results in the breaking up of these peroxides with the evolution of hydrogen peroxide as well as such products as lower acids, aldehydes, carbon dioxide and water. A film of linseed oil continued to evolve hydrogen peroxide until it became a brittle mass. Accepting the evolution of hydrogen peroxide as a measure of the progress of the destructive oxidation, then the sources of light used in accelerated testing should have a decided maximum in the region of the spectrum 4300 to 3000A.—H. M. Langton.

Separation of Oils or Fats (from Blubber and Oil-Bearing Tissues of Marine Animals). Chemical Engineering Co. (Manchester), Ltd., J. W. Spensley and J. W. Battersby (E. P. 241,276, 16.7.24 and 24.2.25). By feeding strips of blubber or oil-bearing tissue into the central aperture of the high-speed pinned disc mill described in E. P. 186,462 (J., 1922, 886 A), revolving at a peripheral speed of about 20,000 ft. per min., the separate fibres in the blubber are opened up in

such manner as to destroy the oil-bearing cells formed by the relative crossing of the fibres. The oil can then be separated from the fibres by keeping or by means of sieves, after slight heating if necessary. Further oil can be obtained from the fibrous residue by pressing or by centrifugal treatment. The residual fibre may then be further treated for production of gelatin.—A. De Waele.

Separation of Fats from Animal Tissues. Chemical Engineering Co. (Manchester), Ltd., J. W. Spensley and J. W. Battersby (E. P. 241,804, 16.7.24 and 24.2.25). The process described in E. P. 241,276 (preceding) is applied to the extraction of fats solid at the ordinary temperature, e.g., beef fat and mutton fat from kel fat, lard from pig leaf, etc. After the mechanical treatment the mass is warmed to a temperature somewhat above the melting point of the fat.—H. M. Langton.

Extraction of Oil from Palm Fruit and the Like. T. Dickinson, F. J. Brimley and Nigerian Products, Ltd. (E. P. 241,297, 21.7.24). Palm fruit or the like is treated in a closed stationary vessel supplied with superheated steam and fitted with beaters or arms, whereby the pericarp is pulped and the nuts are rendered easy to crack and open. The mass is separated from the liquid by centrifuging, and conveyed to a hollow rotary dryer supplied with hot gases; the nuts are separated from the dry fibre in a rotary separator, then cracked, and the broken nuts screened prior to the separation of the kernels from the broken shell.

Digesters or Sterilizers for Treating Palm Fruit and Like Nuts Provided with a Fibrous Covering Containing Oil or Fat. C. Downs and R. A. Bellwood (E. P. 241,298, 22.7.24). A digester having a greater height or length than its diameter is provided with a rasp-like abrasive liner on its inner surface, and with a shaft and stirers similarly furnished with rasp-like faces on their exterior surfaces, the faces being preferably inclined. The digester is provided with steam inlets at a number of points.—A. De Waele.

Plant for Removal of Free Fatty Acids and Other Impurities from Oils, Fats and the like. Lever Bros., Ltd., R. Craig and C. E. C. Shawfield (E. P. 242,316. 9.5.24). The plant described is for treating fats, oils and the like (for example the purified oil of E. P. 224,928; B., 1925, 45) by means of fresh steam under low pressure. The liquid material is passed into a horizontal treatment vessel, long in comparison with its width, divided into compartments by means of baffles, so arranged that steam is admitted into the liquid in each compartment. It is constructed of an alloy (containing about 90 per cent of aluminum, together with copper, with or without a small proportion of other metals, e.g., nickel or magnesium), which is not corroded by free fatty acids even when hot. A substantially uniform low absolute pressure is maintained throughout the vessel, which is heated so that the free fatty acids are eliminated with the steam, and a constant level of liquid is maintained in it. Air is prevented from obtaining access to the treated oil until it is cool.—D. G. Hewer.

Hydrogenation of Oils. Edgar A. Knowles, Chemistry & Industry (Feb. 19th page 121, and Feb. 26th, page 127). A very good article dealing chiefly with electrolytic production of hydrogen, and is recommended to those interested in the subject.

Studies in Filtration. This is the Journal of the Society of Chemical Industry Transactions No. 1-T (January 1, 1926). Careful study of a subject from an engineering standpoint. The article is too long to be abstracted satisfactorily.